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A NEW METHOD FOR EFFICIENT HEAT DETECTION IN LARGE-SIZE BUFFALO HERDS

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ABSTRACT

This study aimed at the adoption of an efficient method of heat detection in buffalo raised in large herds. For that, fourty two pluriparous buffalo calvers were used in this study. Calvings were distributed over a nine-months period extending from August, 1998 to May, 1999. The post-partum reproductive traits of the dry-season calvers (n=30) were compared to those of the green-season (n=12). The results of 92 heats, 110 ovulations and 671 peripheral blood samples (analized for P_4 concentration) were scrutinized.

Heat detection was performed starting from the 2nd week post-partum until the pregnancy was confirmed. Visual observation of estrus was conducted throughout the 24 hours of the day using a T.V-closed circuit unit. Heats were also detected using four types of detector animals i.e., a testosterone-treated buffalo cow, a testosterone-treated buffalo heifer (each was fitted with a chin-ball marking harness), a vasectomized buffalo bull and an intact buffalo bull.

The overall mean of uterine involution period, post-partum ovulation interval, post-partum ovulatory heat interval, number of days-open and calving interval were 36.8±1.2, 39.0±3.6, 49.1±4.6, 75.6±4.5 and 392.2±0.4 days, respectively.

The green-season buffalo calvers had significantly (P<0.05) lower incidence of quiet ovulations, higher conception rate-to the 1st service and longer gestation period as compared to those of the dry-season calvers. The corresponding estimates of these traits were 10.0 vs. 16.4%, 83.3 vs. 60.0% and 323.0±2.2 vs. 314.1±1.8 days, respectively. Nevertheless, the conception rate after the 2nd service and the ultimate calving interval did not show any significant differences due to season of calving.

Heat detection efficiency (HDE) showed significant variations (P<0.05) among the different methods of heat detection used. The calculated estimates of HDE were 97.7% for the androgenized buffalo cow, 91.3% for the androgenized buffalo heifer, 87.1% for the vesectomized buffalo bull, 87.9% for the intact bull and 82.3% for the visual observation method. The corresponding efficiency estimated for detecting quiet ovulations were 82.8%, 65.5%, 41.4%, 44.8% and 0.0%, respectively.

It has been shown that well managed buffalo cows raised in large-herds are capable to maintain regular reproductive capacity throughout the year-round. In these herds, the use of an androgenized buffalo cow fitted with a chin-bull marking harness could be suggested as an efficient, sanitary and economic method of heat detection.

INTRODUCTION

It has been well established that accurate heat detection is the essential prerequisite for efficient reproductive management in bovine (Timms, 1985 and Pierson & Ginther, 1988) and buffalo (Drost *et al*., 1985; Jainudeen, 1986 and Barkawi *et al*., 1992).

Visual observation of estrus in large-size buffalo herds has traditionally been regarded as a frustrating laborious task. Otherwise, the magnitude of the problem at the level of small holders is low and usually unpronounced. This could be attributed to the fact that the small holder (possessing ≤3 buffalo cows) can easily recognize the characteristic vocalization, frequent urination, restlessness, drop in milk production and loss of appetite manifested by the estrous animal. The accidental mucous discharge, vulva swelling and redness of the labio-vaginal mucosa are also reliable signs if present and could readily be noticed by the holder who is normally familiar with the individual behaviour of his animals (Aboul-Ela *et al*., 2000).

In large-size buffalo herds, it is difficult for the herds men to visualize and follow-up the tiny behavioral changes of individuals occurring during estrus (Joosten *et al*., 1985). More importantly, the inherently high incidence of quiet ovulations (Barkawi, 1981); weak heat symptoms (Aboul-Ela, 1989); secretion of little amounts of estrous-mucous (Drost, 1991) and lack of the female homosexual behavior (Zicarelli, 1991) are the major estrus phenomena in buffalo. Hence, the sole dependence on the naked eyes to detect estrus in these herds is unlogic and usually leads to misleading results. This contradicts the situation in bovine as heat manifestation is obvious and the incidence of female homosexual behavior is high (Drost *et al*., 1985 and Aboul-Ela *et al*., 2000).

It is the author's concept that heat detection in buffalo raised in large herds should be performed using a different methodological approach.

This work aimed at the evaluation of different methods for heat detection in large-size buffalo herds with special attention to the use of an androgenized female buffalo as a heat detector animal. The impact of calving season on the reproductive performance of these herds was also studied.

MATERIAL AND METHODS

This study was conducted at Mehallet Moussa Research Station, Animal Production Research Institute, Ministry of Agriculture, during the period from August, 1998 until May, 1999. The farm is located in the North-Center of Nile Delta, Kafr El-Sheikh Governorate, Egypt.

Buffalo cows and management:

Fourty two clinically normal pluriparous buffalo calvers were used. Calvings covered the period extending from August, 1998 until May, 1999. All buffalo cows had normal calvings. They ranged in their ages between 4-14 years and parities between the 2nd and 9th lactations. By the end of the 1st week post-partum, the dams were separated from their newborns and began to hand-milking (twice daily) until the end of lactation.

The dams had their feeding rations on the basis of thire body weight and level of milk production (APRI, 1997). The dry-feeding implemented herein represented the period from August to December, while the green feeding represented the time interval from January to May.

The dams were kept in a 8X20 meters-open fenced yard with 5 meters height asbestos sheds. They were separated from the yard twice daily to have their drinking water (at 7.00AM and 3.00PM) and then, the concentrate rations (at 8.00AM and 4.00PM) while being hand milked. The total time spent outside the yard did not exceed 3 hours a day. The roughage rations of the season were introduced to the dams in the yard.

Experimental procedures:

Preparation of the androgenized females:

Two sexually mature non-lactating,moderately aggressive and completely sterile female buffalo (a primiparous buffalo cow and a nuliparous buffalo heifer)were prepared for use as heat detector animals.The experimental females aged 6.5 and 3.5 years and weighted 550 and 390 kg, respectively.

Each female was intramuscularly injected with 2g testosterone enanthate (CTD Inc.) as an initial dose, and was fitted with a chin-ball marking harness (Fig.1&2). Two weeks later each female received a second dose of 1g of the same drug. Finally, a booster dose of 500mg was injected to each female at 2-weeks intervals until the end of the study.

The chin-ball marking device:

The marking device consisted of a double strapping leather halter attached to a stainless steel paint reservoir that reaches a rolling-ball marker. The straps were fastened at slight angles (around the forehead and behind the horns) to provide the best fit of the reservoir under the chin of the detector animal (Fig. 2). So that, when the animal presses down with its chin on rump of an estrous buffalo cow (during mounting), the valve of the paint-loaded reservoir is opened and the marking fluid released. It worths to mention that the female teasers started to show the male-like behavior including: smelling, sniffing, licking of the external genital organs, Flehmen posture, chin resting and mounting of the estrous animal 10-15 days after the 1st injection dose (Fig. 3, 4, 5 and 6).

Heat detection and breeding procedure:

The dams were successively introduced to the heat-detection yard by the end of the 2nd week PP. The maximum number of the dams joined to the yard (at a time) did not exceed a total of 25 females. Heats were observed throughout the 24 hours of the day using a closed-TV circuit unit. The unit consisted of one fixed and another moving cameras installed in the heat-detection yard. The cameras were connected to a TV/ Video cassette recorder (VCR) system located in the observation room.Two VCR's were available (one for live display and the other for recording).The androgenized buffalo cow was kept permanently within the female group.The marks of the mounted females were recorded every six hours (at 6.00 AM, 12.00 noon, 6.00PM and 12.00 midnight) by two-shift observes.At each observation round, the detector female was brought out of the yard and each of the other detector animals (the androgenized heifer, the vasectomized and the intact buffalo bull) was separately joined to the yard and allowed to run freely within the dams for half an hour. Mountings were recorded for each detector animal.

Most breedings were conducted during the standing estrus using the intact detector bull. Forced breedings were performed if the estrus was pretended by at least one of the comparable methods of heat detection, while the standing behavior was lacking.

Blood sampling and progesterone (P_4) assay:

A total of 671 peripheral blood samples were obtained from the jugular vein and analysed for P_4 concentration. Blood sampling was started from day 15 PP and then at 5-day intervals until the pregnancy was confirmed. An extra blood sample was collected on the day of heat to assure the occurrence of ovulation. Blood specimens were kept on ice for approx. 30 minutes before they transferred to the lab.

Fig 1: The chin-ball marking harness.

Fig 2: The chin-ball marking device being fitted to the head of the female teaser.

Fig 3: The female teaser showing Flehmen posture.

Fig 4: An estrous buffalo cow being mounted by the female teaser.

Fig 5: The female teaser showing the chin-resting posture on the back of an estrous buffalo cow.

Fig 6: Marking paint being released on the rump area of an estrous buffalo cow.

The specimens were centrifuged at 500x g for 15 minutes, then, the plasma separated and finally stored at -20º C until the time of P_4 determination using the RIA technique. A pre-coated antibody tube kits (Diagnostic Systems Laboratories, Texas, USA) were used. The cross reaction for the antibody was 100% with P_4 and < 0.1ng/ml with any other steroids. The sensitivity value was 0.12 ng/ml. The intra and inter assay variation coefficients were 8.0 and 13.1%, respectively.

Clinical examination of the reproductive organs:

The female reproductive tract and the ovaries were examined at weekly intervals starting from day-15 PP until the time of 1^{st} service (the voluntary waiting period was 40 days post-calving). Rectal examination was temporally stopped after the 1^{st} service, then, the ovarian activity was assessed by monitoring P_4 levels in the blood plasma. Served females that returned to heat were rectally checked for the uterine tone and the presence of cyclic structures on the ovaries before further breedings were performed. Buffalo cows that did not return to breeding within 45-60 days post-service were palpated for pregnancy diagnosis. The pregnant females were successively excluded from the yard to allow the detector animals to concentrate on the remainder of the female group.

Reproductive traits:

The true (ovulatory) heats; false (anovulatory) heats and quiet ovulations (QO) were determined on the basis outlined by Barkawi *et al*. (1998) considering both field observations and P_4 profiles. The different estimates of the uterine involution period (UIP), post-partum ovulation interval (PPOI); post-partum ovulatory heat interval (PPOHI); service period (SP); number of services /conception (NS/C); conception rate (CR); gestation period (GP) and calving interval (CI) were computed for both the green and dry-season calvers. Heat detection efficiency, HDE, (Timms,1985) as well as heat detection accuracy,HAD, were calculated according to the following equations:

$$\text{HDE} = \frac{21}{\text{Inter - estrous intervals}} \times 100 \qquad \text{HDA} = \frac{\text{Number of true heats}}{\text{Total observed heats}} \times 100$$

As "21" = The average length of normal estrus cycle (Drost, 1991 and Beg & Totey, 1999), Inter-estrus intervals = Average interval between estrous events, Number of true heats = Number of ovulatory heats and Total observed heats = Number of true heats + number of false heats. The different estimates of inter-estous intervals, HDE and HDA were recorded for each method of heat detection and comparisons were made.

Statistical analysis:

The statistical analysis was performed using the Linear Model Program of SAS (1995). The model included two fixed factors (methods of heat detection and season of calving). The χ^2 test was used to determine the statistical significance between the traits expressed as percentages.

RESULTS AND DISCUSSION

Reproductive performance as affected by season of calving:

The impact of calving season on the reproductive traits of buffalo cows is shown in table 1. It could be seen that the reproductive performance of the green-season calvers is slightly better to that of the dry-season. Nevertheless, the differences between the two seasons were statistically nonsignificant in most traits studied. This may reflect the efficacy of the implemented management throughout the course of the study. However, the diminished seasonal impact on the reproductive performance of well managed buffalo is not new and well established by many workers (El-Wishy & El-Sawaf, 1971; Barkawi, 1981; Sastry *et al*., 1981; Gill & Rurki, 1985 and Bayoumi, 2001). The same concept was also emphasized for buffalo bulls kept on a sustained regular management (El-Fouly *et al*., 1992; Osman, 1996 and Osman *et al*., 2000).

Table 1: Impact of season of calving on some reproductive traits of buffalo cows raised in large-size herds.

Trait	Dry season buffalo calvers (n=30)	Green season buffalo calvers (n=12)	Overall mean±SE (n=42)
Uterine involution period (d)	37.9±1.4 ^{A}	34.0±1.9^{A}	36.8±1.2
Post-partum ovulation interval (d)	39.6±4.1 ^{A}	37.8±7.8 ^{A}	39.0±3.6
Post-partum ovulatory heat interval (d)	47.5±5.0 ^{A}	53.2±10.2 ^{A}	49.1±4.6
Service period length (d)	40.4±4.9 ^{A}	34.9±8.7 ^{A}	38.8±4.3
Days open (d)	78.3±5.0 ^{A}	68.9±9.6 ^{A}	75.6±4.5
Incidence of Quiet ovulation (based on visual obs)	16.4%^{B} (18/110)	10.0% ^{A} (11/110)	26.4% (29/110)
Number of services/conception	1.4±0.1 ^{A}	1.25±0.2 ^{A}	1.4±0.1
First service- Conception rate	60.0% ^{B} (18/30)	83.3% ^{A} (10/12)	66.6% (28/42)
Second service-CR	36.7% ^{A} (11/30)	8.3%^{B} (1/12)	28.6% (12/42)
Total CR after the second service	96.7% ^{A} (29/39)	91.6% ^{A} (11/12)	95.2% (40/42)
Third service-CR	3.3%^{A} (1/30)	8.3% ^{A} (1/12)	4.8% (2/42)
Gestation period (d)	314.2±1.8 ^{B}	323.0±2.2 ^{A}	316.8±1.5
Calving interval (d)	392.7±4.7 ^{A}	390.9±8.0 ^{A}	392.2±4.0

Means bearing different superscripts in the same raw differ significantly (P<0.05).

Although, the green-season buffalo calvers has significantly (P<0.05) lower incidence of quiet ovulations (10.0 vs. 16.4%) and higher CR- to the 1st service (83.3 vs. 60.0%), neither the DO, nor the NS/C, nor the total CR after the 2nd service showed any significant differences due to season of calving (Table 1). Ultimately, but most importantly, the CI was almost similar (390.9±8.0 vs. 392.7±4.7 days) for both calving seasons, respectively.

Disregarding the seasonal impact, the reproductive estimates presented here are generally superior to those reported by the vast majority of investigators for buffalo cows raised in large-herds (El-Fouly *et al*., 1976; Jainudeen, 1986; Barkawi *et al*., 1992 and 1998). More interestingly, the current reproductive estimates are also superior to those reported for buffalo cows kept at the level of small holders (El-Khaschab *et al*., 1984; Aboul-Ela, 1992 and El-Wardani *et al*., 2000). The results of this part clearly manifest the outstanding reproductive capacity of this animal, on one herd, and emphasize the importance of strict management to uncover this capacity, on the other hand.

As shown in Table 1, the GP of the dry-season calvers (314.2±1.8 days) was significantly (P<0.05) shorter to that of the green-season (323.0±2.2 days). The reason is not clear and needs specific investigation. However, in this study, the majority of the dry-season calvers gave their subsequent births during the following dry (hotter) calving season, the time which could probably be coincided with elevated levels of the stress-corticosteroid hormones, which are in-turn responsible for the enhancement of placental maturation (Otzel *et al*., 1983), resulting in an earlier termination of pregnancy.

The incidence of quiet ovulations (QO) as determined by the blood- P_4 levels and the confirmation of the 24-hours visual observation of estrus (by the TV-closed circuit) was 26.4%. Although rather high, this incidence is obviously lower to the most corresponding estimates found in the literature (Barkawi *et al*., 1986; Aboul-Ela *et al*., 1987 and Khattab *et al*., 1990).

It could be seen that even under the most optimum management conditions and intensive visual observation of estrus, a considerable incidence of QO (26.4%) has been still encountered. This simply emphasises that the sole dependence on the naked eyes to detect estrus in large-size buffalo herds is unreliable and usually results in plenty of missed ovulations. In such herds, the phenomenal weak estrous manifestation, lowered incidence of estrous vocalization and the rarely encountered/ or entirely lacked homosexual behavior among females (Aboul-Ela, 1988; Barkawi *et al*., 1992 and El-Wardani, 1995) support our concept. Thus, another methodological approach should be adopted for more efficient heat detection in large-size buffalo herds, the issue which will be discussed later.

Blood progesterone (P_4) profiles:

All true (ovulatory) heats detected in this study coincided with blood P_4 level of ≤ 0.5 ng/ml (Table 2). Almost similar P_4-levels (≤0.4 ng/ml) were detected on the day of QO. The overall mean P_4-peak of the mid-ovulation cycle was 3.1±0.2 ng/ml. Non of these levels showed any significant differences due to season of calving. These results agreed with the findings of El-Wardani (1995). Otherwise, they contradicted with those reported by Younis *et al*. (1996) who found a significant seasonal effect on the P_4-peak during the luteal phase of the cycle. They recorded P_4 peaks during that phase of 3.1 & 3.7 ng/ml for the dry and green-calving seasons, respectively, the values which were nearly similar to the corresponding levels (3.2±0.2 and 2.8±0.4 ng/ml) recorded in the present study (Table 2).

The overall mean P_4-level on the day of false heat (FH) were 1.1±0.9 and 0.1±0.1 ng/ml during the dry and green calving seasons, respectively (Table 2). The difference between the two seasons was statistically significant (P<0.05). Two out of the 11 false heats detected (18.1%) coincided with the presence of a CL on one of the two ovaries and P_4 levels of ≥1.0 ng/ml. Both cases were dry-season calvers. It worths to mention that all cases of FH detected in this study (based on the visual observation and P_4 profiles) were not accompanied by firm standing while being mounted by any subject of detector animals. This finding came in a partial agreement with the results of El-Wardani (1995) who found that about 50% of buffalo cows with false heats were reluctant to stand firmly to the bull during copulation.

The mean- P_4 peak of early gestation (during the 1st two mo. of pregnancy) was insignificantly higher in the green than in the dry-calving season (5.3±0.7 vs. 4.6±0.3 ng/ml), respectively. These values were almost similar to the corresponding values reported by Batra *et al*.(1979) for Indian buffalo, and rather high than those recorded by Farghaly (1992) for Egyptian buffalo. The lack of seasonal impact on the P_4 profiles during the different physiological events studied clearly denotes a regular ovarian function throughout the year-round.

Incidence of detected heats; quiet ovulations and total ovulations in relation to heat detection method:

As shown in Table 3, the use of the androgenized buffalo cow has resulted in the highest incidence of captured true heats (93.1%). While this incidence did not vary significantly with those of the androgenized buffalo heifer (92%), the vasectomized buffalo bull (89%) and the fertile buffalo bull (89%), it differed significantly (P<0.05) with that of the visual observation method (88%). This trend reflected corresponding percentages of false heats of 3.9; 8.0; 11.0; 11.0 and 12.0% for the different methods of heat detection, respectively. However, the entire cases of true heats recorded in this study (n=81) were uniformly recognized by all methods of heat detection with a 100% efficiency. This percentage was similar to that obtained by El-Wardani and El-Asheeri (2000) employing a four-times heat checks (daily) regimen. It worths to mention that the significantly (P<0.05) inferior percentages of true heats (88%) and the concurrent false heats (12%) stuck with the visual observation method in this study have been still superior to the corresponding percentages found in the literature (El-Sheikh and Mohamed, 1976; Borady *et al*., 1982 and El-Wardani, 1995).

The androgenized buffalo cow had the highest efficiency (P0.05) for detecting QO (82.8% out of the total 29 QO's recorded). The corresponding efficiency estimates for the androgenized heifer; the vasectomized bull; the fertile bull and the visual observation method were 65.5; 41.4; 44.8 and 0.0%, respectively. It was also shown that the ultimate percentages of the total ovulations detected by the different methods of heat detection were 95.5; 90.9; 84.5; 85.5 and 73.6%, respectively. The counter-part percentages of missed (undetected) ovulations were 4.5; 9.1; 15.5; 14.5 and 26.4%, respectively. These results clearly demonstrate the superiority of the androgenized buffalo cow for detecting QO, the traditional obstacle which afflicted reproductivity of this animal for long decades. It should be mentioned that the recorded incidence of missed ovulation relative to the use of the androgenized buffalo cow (4.5%) is the least figure ever found in the available literature (Barkawi, 1981; Jainudeen *et al*., 1983; Aboul-Ela *et al*., 1987; El-Wardani, 1995 and El-Wardani and El-Asheeri, 2000).

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Inter-estrous intervals:

The impact of heat-detection method on the inter-estrous intervals (estrous cycle length) is shown in Table 4. The use of the androgenized buffalo cow has resulted in the lowest mean estrous cycle length (21.5±1.1 days). Conversely, the highest mean interval (25.5±1.3 days) was recorded for the visual observation method ($P<0.05$). Nevertheless, variations in this trait among the different experimental types of detector-animals were statistically nonsignificant. Regardless of heat-detection method used, the current inter-estrous intervals were in general accord with the means reported by Beg and Totey (1999) for Indian buffalo and Khalil (2001) for Egyptian buffalo. The differences among the various studies could, in large part, be attributed to the efficiency of heat-detection regimen adopted (Barkawi *et al*., 1998; El-Wardani and El-Asheeri, 2000 and Khalil, 2001).

Heat-detection efficiency (HDE):

The use of the androgenized buffalo cow resulted in the highest HDE (97.7%), otherwise, this estimate reached its lowest level (82.3%; $P<0.05$) when the visual observation method was used (Table 4). However, the differences among the androgenized buffalo cow, the vasectomized buffalo bull and the intact buffalo bull lacked statistical significance.

In their study, Barkawi *et al*. (1998) using the equation of Timms (1985) found that HDE was 86.1% when buffalo cows were checked for heat 4 times a day, and this efficiency declined dramatically to 39.9% as the number of heat-checks decreased to 2 times a day.

Heat detection accuracy (HDA):

The estimates of HDA had almost the same trend imposed by the HDE (Table 4). The significant superiority ($P<0.05$) of HDA for the androgenized females over the visual observation method comes in complete accord with the aforementioned results of this study. Moreover, it confirms our previous concept that the visual observation of estrus should not be the method of choice for heat detection in large-size buffalo herds.

It has been concluded that in large-size buffalo herds, the use of an androgenized buffalo cow fitted with a chin-ball marking harness could be suggested as an efficient, sanitary and economic method of heat detection.

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طريقة جديدة لاكتشاف الشياع بكفاءة فى قطعان الجاموس الكبيرة

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أجريت هذه الدراسة بمحطة بحوث الإنتاج الحيوانى بمحلة موسى – محافظة كفر الشيخ – التابعة لمعهد بحوث الانتاج الحيوانى. واستهدفت الدراسة محاولة استنباط طريقة فعالة لاكتشاف الشياع فى قطعان الجاموس ذات الكثافة العددية الكبيرة – وذلك من خلال اجراء تقييم شامل لخمسة طرق مختلفة لاكتشاف الشياع فى هذه القطعان وهى: طريقة المراقبة البصرية، استخدام الذكر الكشاف المقطوع الوعاء الناقل، استخدام الذكر الكشاف الصحيح تناسليا، استخدام عجلة جاموس معاملة بالهرمون الذكرى وأخيرا استخدام جاموسة ناضجة معامله بالهرمون الذكرى. كما تناولت الدراسة بالبحث تأثير فصل الولادة على الأداء التناسلى للجاموس.

وقد استخدم فى هذه الدراسة عدد ٤٢ جاموسة توزعت ولاداتها لتمثل كل من فصلى التغذية الصيفية الجافة (٣٠ جاموسة)، والتغذية الشتوية الخضراء (١٢ جاموسة). هذا وقد اظهرت نتائج ٩٢ شياعا، ١١٠ تبويضة، ٦٧١ عينه دم تم تقدير تركيز هرمون البروجسترون بها (باستخدام احد طرق التقدير بالمناعة الإشعاعية) ما يلى:

كان المتوسط العام للوقت اللازم لارتداد الرحم بعد الولادة هو ٣٦,٨±١,٢ يوما، الوقت من الولادة حتى أول تبويض هو ٣٩,٠±٣,٦ يوما، الوقت من الولادة حتى أول شياع ٤٩,١±٤,٦ يوما، عدد الأيام المفتوحة ٧٥,٦±٤,٥ يوما كما كانت الفترة بين ولادتين ٣٩٢,٢±٠,٤ يوما. وقد أظهرت الدراسة انخفاضا معنويا في معدل التبويضات الصامتة، وزيادة المعنوية فى معدلات الإخصاب من أول تلقيحه خلال فصل التغذية الشتوية مقارنه بفصل التغذية الصيفية. هذا وقد تلاشت الفروق المعنوية بين معدلات الإخصاب بين فصلى الولادة بعد التلقيحة الثانية، كذلك فإنه لم تسجل اى اختلافات معنوية في صفة الفترة بين ولادتين بين الفصلين موضع الدراسة (٣٩٠,٣±٠,٨، ٣٩٢,٧±٤,٧ يوما على الترتيب).

اختلفت كفاءة كشف الشياع معنوياً بين طرق كشف الشياع المختلفة. فكانت تقديرات هذه الكفاءة ٩٧,٧% للجاموسة الكشافة، ٩١,٣% للعجله الكشافة، ٨٧,١% للذكر المقطوع الوعاء الناقل، ٨٧,٩% للذكر الصحيح تناسلياً، ٨٢,٣% لطريقة الكشف بالمراقبة البصرية. كذلك فقد كانت كفاءة كشف التبويضات الصامتة بين الطرق المختلفة المستخدمة هي ٨٢,٨%، ٦٥,٥%، ٤١,٤%، ٤٤,٨%، صفر %- على الترتيب.

وتؤكد الدراسة انه تحت نظم الرعاية الجيدة فإن الجاموس المصري له القدرة على التناسل بكفاءة على مدار العام. كذلك فإن طريقة كشف الشياع في قطعان الجاموس الكبيرة باستخدام الأنثى الكشافة المعاملة بالهرمون الذكرى تعتبر الطريقة المثلى كوسيلة سهلة وفعالة واقتصادية حيث أنها توفر تكاليف أجور العمالة الخاصة بأعمال المراقبة البصرية للشياع ، كما انها توفر نفقات الاحتفاظ بالطلائق المستخدمة في أغراض الكشف ، بالإضافة الي المردود الاقتصادي الناتج عن خفض معدلات الشياع المهدر – وخاصة أثناء فترة الليل وما يستتبعه من رفع معدلات الخصوبة المتحصل عليها ، كذلك فان الطريقة المقترحة تحول دون انتقال الأمراض التناسلية التي تنتقل عن طريق الجماع ، وتساهم بكفاءة في التغلب على مشكلة التبويض الصامت فى هذا الحيوان.

Table 2: Blood-P_4 concentration (ng/ml) in-relation with some physiological events and with season of calving in large-size buffalo herds.

Progesterone concentration (ng/ml)	Dry season buffalo calvers (n=30)		Green season buffalo calvers (n=12)		Overall mean±SE (n=42)	
	Mean±SE	Range	Mean±SE	Range	mean±SE	Range
On the day of true heat	01±0.02^{A} (63)	ND- 0.5	0.14±0.04^{A} (18)	ND- 0.5	0.11±0.02 (81)	ND- 0.5
On the day of false heat	1.1±0.9^{A} (9)	ND- 8.0	0.1±0.10^{B} (2)	ND- 0.2	0.9±0.70 (11)	ND- 8.0
On the day of quiet ovulation	0.1±0.03^{A} (18)	ND- 0.4	0.1±0.03^{A} (11)	ND- 0.4	0.1±0.02 (29)	ND- 0.4
On the day of ovulation	0.1±0.01^{A} (81)	ND- 0.5	0.12±0.02^{A} (29)	ND- 0.5	0.1±0.01 (110)	ND- 0.5
Peak of mid-ovulation cycle	3.2±0.20^{A} (53)	1.0-9.0	2.8±0.40^{A} (17)	1.0-6.2	3.1±0.20 (70)	1.0-9.0
Peak of the 1st 2mo. Pregnancy	4.6±0.3^{A} (30)	1.8-9.5	5.3±0.70^{A} (12)	2.1-9.0	4.8±0.3 (42)	1.8-.95

Means bearing different superscripts in the same raw differ significantly (P<0.05).

Table 3: Impact of heat-detection method on the different percentages of true heats, false heats, quiet ovulations and total ovulations detected.

Trait	Androgenized buffalo-cow		Androgenized buffalo-heifer		Vasectomized buffalo bull		Fertile buffalo bull		Visual observation	
Percent true heats recorded	93.1%^{A}	(81/87)	92.0%^{A}	(81/88)	89.0%^{AB}	(81/91)	89.0%^{AB}	(81/91)	88.0%^{B}	(81/92)
Percent false heats recorded	6.9%^{A}	(6/87)	8.0%^{A}	(7/88)	11.0%^{AB}	(10/91)	11.0%^{AB}	(10/91)	12.0%^{B}	(11/92)
Percent true heats detected	100%	(81/81)	100%	(81/81)	100%	(81/81)	100%	(81/81)	100%	(81/81)
Percent missed (undetected) ovulations	4.5%^{A}	(5/110)	9.1%^{AB}	(10/110)	15.5%^{B}	(17/110)	14.5%^{B}	(16/110)	26.4%^{C}	(29/110)
Percent quiet ovulations detected	82.8%^{A}	(24/29)	65.5%^{B}	(19/29)	41.4%^{C}	(12/29)	44.8%^{C}	(13/29)	0.0%^{D}	(0/29)
Percent total ovulations detected	95.5%^{A}	(105/110)	90.9%^{Ab}	(100/110)	84.5%^{B}	(93/110)	85.5%^{B}	(94/110)	73.6%^{C}	(81/110)

- Figures in parenthesis represent the number of observations.
- Means bearing different superscripts in the same raw differ significantly (P<0.05).

Table 4: Impact of heat-detection method on the inter-estrous intervals (days), efficiency and accuracy of heat detection (%) in large-size buffalo herds.

Trait	Androgenized Buffalo-cow	Androgenized buffalo-heifer	Vasectomized buffalo bull	Fertile buffalo bull	Visual observation
Intervals between estrous events (days)	21.5±1.1^{A} (55)	23.0±1.6^{AB} (53)	24.1±1.8^{AB} (50)	23.9±1.5^{AB} (51)	25.5±1.3^{B} (46)
Heat-detection efficiency (HDE)	97.7%^{A}	91.3%^{AB}	87.1%^{B}	87.9%^{B}	82.3%^{C}
Heat-detection accuracy (HDA)	93.1%^{A}	92.0%^{A}	89.0%^{AB}	89.0%^{AB}	88.0%^{B}

- Figures in parenthesis indicate the number of intervals between estrous events.
- Means bearing different superscripts in the same raw differ significantly (P<0.05).